Outstanding Projects for 2003

Four projects in this year's annual progress report exemplify outstanding coordination, design, and implementation:

- Jim Ford Creek Watershed Enhancement Project
- Thomas Fork Stream Bank Protection Project
- Medicine Lodge Creek Total Maximum Daily Load (TMDL) Implementation Project
- Paradise Creek TMDL Implementation Project

Summaries for each of these outstanding projects are presented in the following sections.

Thomas Fork Stream Bank Protection Project

(This is an edited, reduced version of a detailed report, titled Thomas Fork Creek Implementation to Rehabilitation, submitted to DEQ from project manager, Mr. Mitch Poulsen of the Bear Lake Regional Commission. Mr. Poulsen's entire photo-essay report, covering seven years of stream bank stabilization progress, is on file with the DEQ State Office.)

Location

The Thomas Fork Watershed encompasses 150,100 acres of Idaho and Wyoming, straddling the southeastern corner of Idaho within townships 10, 11, 12, 13, and 14 south, ranges 45 and 46 east of Bear Lake County, and in western Wyoming within townships 26,27,28,29, and 30 north, ranges 118,119, and 120 west within Lincoln County (Figure 5). The Sublette range bounds Thomas Fork Valley on the east, and the Pruess range bounds it on the west. Mountain elevations in the area range from 6,000 feet to 9,600 feet above sea level. The headwaters are in Lincoln County, Wyoming, as Salt Creek, which changes into Thomas Fork Creek once over the Idaho border. From there, Thomas Fork Creek meanders twenty-seven river miles through Bear Lake County to the confluence of the Bear River, emptying into Bear Lake, which has been designated a "special resource" water by the Idaho Legislature.

Land Use Practices

Agricultural practices represent the greatest use of the valley, with recreation playing a lesser role. Over 90% of the land is planted in harvest crops, such as alfalfa and grain, while the rest is used for dairies and grazing.

No one single practice is responsible for the deteriorated condition of the stream banks along Thomas Fork:

- Irrigation canals traverse the valley floor, providing necessary water to agricultural operations, and this same principle was applied to Thomas Fork to expedite water delivery to downstream users. Meander bends were removed in certain segments in an effort to provide increased efficiency in water conveyance, but straightening the channel increases the head gradient in the stream, which compounded water quality problems from the stream channel to the stream banks.
- Lack of riparian vegetation along many parts of Thomas Fork is an additional source of water quality degradation. Riparian vegetation acts as a buffer strip to remove nutrients from the water, stabilize the soil, and shade the stream. Without this buffer strip, overland erosion is accelerated, nutrient uptake at the root zone is decreased, and the lack of shade increases the temperature of the water. With no root zone to retain the soil in place, the angle of the bank is increased to near vertical. (Survival of vegetation is directly correlated to the slope of a stream bank: as the angle of a bank is increased, vegetation establishment is decreased.)

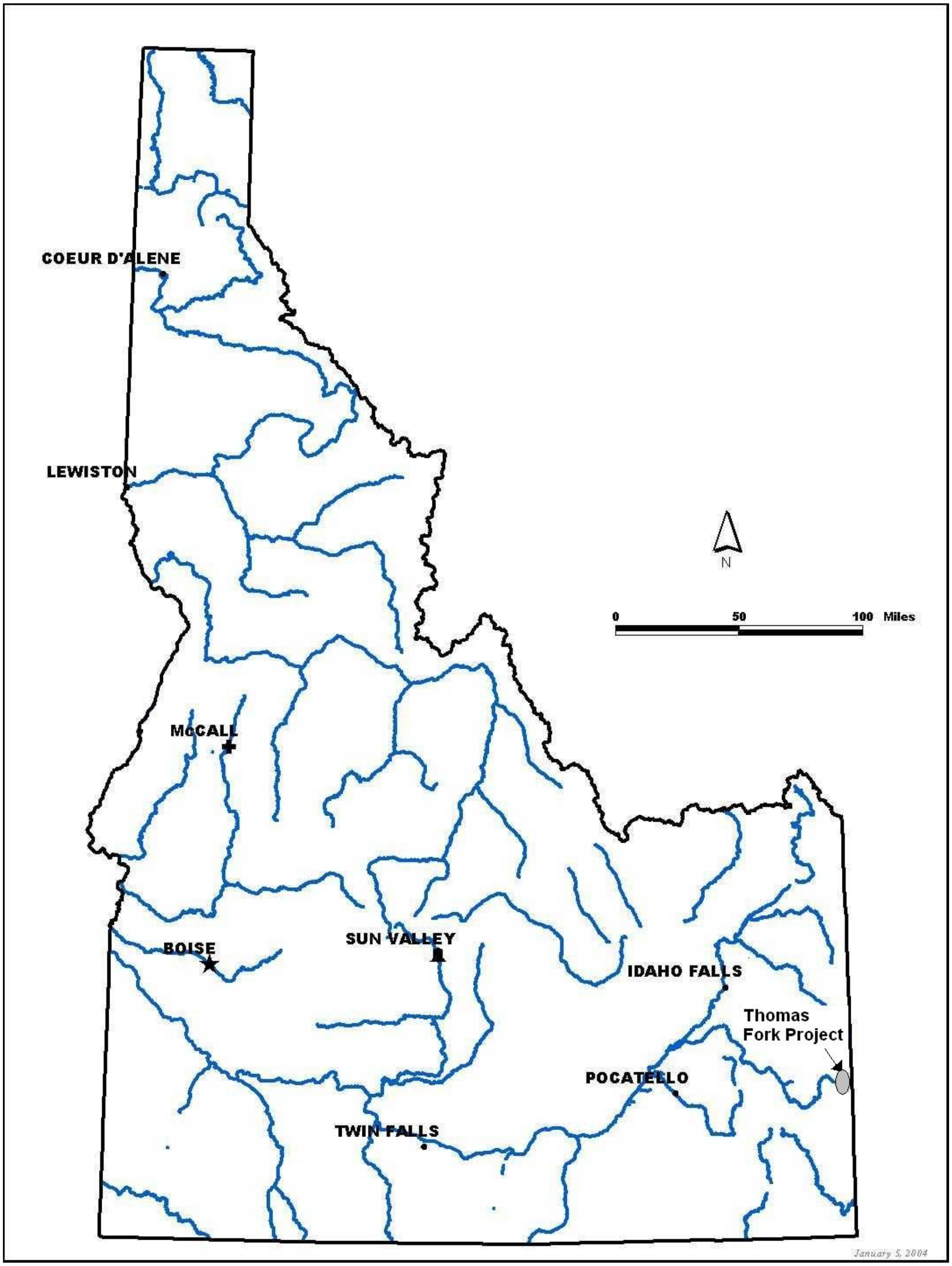

Figure 5: Location map for Thomas Fork Stream Bank Protection Project

Explanation of Best Management Practices (BMPs)

To achieve the purpose of the Clean Water Act that all national waterways be "fishable and swimmable," the Bear Lake Soil and Water Conservation District (BLSWCD) set

Thomas Fork as a priority region within the county to address agricultural issues related to water quality. The State Agricultural Water Quality Plan (SAWQP) produced by the district outlined priority areas of Thomas Fork, those containing the greatest contributors to pollutants, and suggested mitigation techniques to remedy water quality problems.

Eroding stream banks were outlined as the largest single contributor of nutrients (including nitrogen and phosphorus) and sediment to Thomas Fork, and a number of proven mitigation techniques, suggested by the SAWQP plan, have been implemented. To date, 11,262 linear feet of stream bank have been treated with these Best Management Practices (BMPs). The following describes these treatments, in the order they were applied, and their benefits.

Resloping

Stream banks that have been denuded of riparian vegetation are quickly eroded to a slope face of nearly 90 degrees. Heavy construction equipment is used to reduce the angle of these banks to a more stable slope of 2:1 or 3:1, as suggested by the National Resources Conservation Service (NRCS) as suitable for revegetation of riparian species.

Figure 6 illustrates the effect of bank shaping. Left of the trackhoe is a vertical face, nearly 10 feet above the Thomas Fork Creek (at normal flow). A reduced bank angle provides more floodplain for high flows and better dissipates energy associated with those flow events. Moreover, once the angle of the banks has been reduced to a less critical slope, other techniques are applied to keep the stream bank from reverting to a 90-degree angle.

Figure 6: Heavy equipment used to move soil and place large rocks for stream bank stability.

Stabilizing

Soil on stream banks is covered to prevent erosion during rain events or spring runoff. Native rock is placed over exposed soil—local quarries provide the rock, which is hard, angular, and dense—producing a surface (called rip-rap) that is resistant to weathering and high flows. Typically, rock used for this purpose is 8-12" in diameter (Figure 7).

This technique provides temporary protection from wind and rain until grasses and other vegetation can take root and further stabilize soil and uptake nutrients.

The toe of the slope also benefits from this same technique. Rock is laid end-to-end along the water's edge, and this rock, like that used for rip-wrap, is hard, angular, and dense—but of greater diameter. These rocks are typically 2-3 feet in diameter and are placed by trackhoe, one at a time, rather than by the bucket load.

Figure 7: Toe armoring and rip-rap bank protection techniques

Deflecting

Flow is diverted away from sensitive banks with the use of flow deflection structures (Figure 8). Often referred to as “bank barbs” or “points,” these structures are composed of the same material that covers the exposed banks, only larger and placed specifically according to engineered plans. Large rock is laid end-to-end, pointing upstream, at a 45-degree angle from the bank. Smaller rock is then placed over the large rock to fill interstitial spaces and reduce flow velocity between larger rocks. A key trench is dug into the bank to anchor the structure in place.

Figure 8: Flow deflector or ‘bank barb’ diverting flow away from sensitive areas

The purpose of bank barbs is to absorb energy and deflect the flow away from sensitive areas prone to erosion. The flow of the water is naturally diverted over the structure and away from sensitive areas downstream.

Use of bank barbs to deflect flow away from sensitive areas enhances other river processes immediately downstream of the bank barb. As flow is diverted away from sensitive downstream areas, an “eddy” is formed, creating a region of low velocity flow that forms a gravel bar As a result of the gravel bar, the width to depth ratio of the stream channel is reduced, improving water quality for much of the year and reducing the surface area of the stream exposed to the sun, so that cooler water temperatures are achieved.

Revegetation

Revegetation, which provides long-term sediment and nutrient reduction in addition to other benefits, consists of planting willows (Figure 9) and other on-site vegetation, along with broadcasting a native seed mix on affected areas.

Figure 9: Willow cuttings pressed into toe of bank slope

Willow plantings are cut from healthy on-site communities and pressed into the soil at the toe of all affected slopes. Care is taken to ensure contact is made with the water table at the base of the willow cutting, and the cuttings are planted 4 to 6 inches apart during the late fall or early spring. When possible, entire willow stands (willow plantings) and other existing riparian vegetation are transplanted into the toe of the slope along the bank. Planting during dormancy greatly improves chances of survival.

The seedbed is prepared by using a harrowing device, such as the homemade piece of equipment shown in Figure 10. A six by ten foot piece of nine gauge chain link is cabled to a tractor, or other four wheel drive piece of equipment, and pulled over the ground.

Chain link has shown to be optimal in these circumstances due to the fluid nature of the linkage: the chain link disturbs only soil as it “snakes” along over the rocks and other protrusions. Larger harrows, in contrast, get snagged on rocks and are less maneuverable in confined spaces.

As a final step, seed is broadcast by hand just prior to snowfall—at the recommended density of 30 pounds per acre—then treated by dragging a harrow over the soil.

Figure 10: Harrowing soil after broadcasting seed

A native seed mix, blended at a local seed mill and consisting of sheep fescue, crested wheatgrass, and stream bank wheatgrass, was selected based on site conditions, such as soil type and drought resistance of the seed.

Fencing

Once projects are completed, fencing is used to prevent sensitive areas from being grazed or trampled, while still providing access to water for animals. Commonly used in many locations to separate landowner parcels, fencing has been applied and adapted to the riparian area.

Common fencing can be used to separate animals in the pasture from the riparian area, but it is difficult to keep animals on adjacent properties from using the streambed as a conduit to other pastures. Gap fencing, which is devised to prevent use of the streambed as a conduit, provides a solution.

Gap fencing is constructed using a combination of 3/8” steel cable, welded wire panels, railroad ties, and a tensioning device. Posts are pounded into the ground on opposing sides of the stream, and the panels are set out perpendicular across the streambed from one bank to the bank on the opposing side. The cable is threaded through the panels and secured to one of the newly set posts, while on the opposite post a tensioning device is secured and fastened to the thread of panels. This configuration allows the panels to be raised and lowered depending upon stream discharge. (Raising and lowering the panels according to discharge excludes the channel from being used as a conduit. This technique has proven to be 99% effective.)

Water gaps are another method of fencing that allows animals access to the water in limited areas along the creek with minimal damage to the riparian area. Essentially, a water gap is a deviation in the linearity of a fence that runs to the stream and allows one or two animals at a time to drink. With no room to spread out (caused by the fence) or grass to graze, they drink and move on. This method limits the amount of riparian area trampled to a minimum and still provides water for animals. Numerous methods of construction and materials exist for creating water gaps.

History of 319 projects on Thomas Fork

The purpose of this section is to present, using photo documentation, the progress made on the Thomas Fork Watershed over a period of seven years of BMP implementation. Before and after photographs are used to show improvements to treated areas over time. Other pictures illustrate the current condition of projects that have been completed.

Photographs are arranged in reverse chronological order, starting with the most recently completed project and ending with older projects. Additional photographs can be found in Appendix A, while a table of BMPs applied to all Thomas Fork projects can be found in Appendix B of the complete report, which can be obtained through the DEQ State Office or through Mr. Mitch Poulsen of the Bear Lake Regional Commission.

Project #7 (Garth Boehme)

This is the third bank stabilization project that landowner Garth Boehme has participated in. The photos of Figure 11 and Figure 12 were taken in the fall of 2002 and spring of 2003 after construction. Of particular interest is the width of the channel in these photos. Prior to construction, the creek spanned the channel, but after reducing the angle of the bank and constructing a bank barb, the channel width was reduced. Also of interest is the amount of sediment deposited next to the bank. This occurred during a two-month period over the spring runoff. Because of the recently aggraded gravel bar, new emergent vegetation is starting to take root.

The amount of vegetation present at the site has been an asset. We have been able to experiment with different methods of revegetation and have seen some encouraging results. Prolific stands of willow and sedge have been available for transplant, and we have found that by excavating a hole in the bank next to the water's edge entire willow communities can be transplanted. This has also held true for sedge and reed grasses: a plug, for example, can be transplanted from one location on the project to another without disturbing its life cycle.

The benefit of transplanting whole willow plantings can be seen from Figure 13 and Figure 14. This corner was treated using a mix of willow plantings and cuttings, which resulted in vibrant growth within six months.

The difference between planting and cutting is the number and method used for transplant. A planting involves removal of the entire plant, while a cutting is the selective removal of branches. Planting requires heavy equipment to transplant vegetation from one location to another, while cuttings are cut and pressed into the soil at the water's edge.

The light colored willow in the middle of the picture on the left-hand side of Figure 14 was the only standing vegetation on this cutbank prior to revegetation. All of the rest were willow plantings and cuttings. Willow cuttings are present in this picture although less visible.

This project required treatment of 2,163 linear feet of stream bank and construction of 12 bank barbs. Ecological enhancements include three new pool-riffle complexes and re-defined thalweg (deepest point of the channel). Other improvements of interest at this location include reduction in stream width-to-depth ratio at three locations because of newly formed gravel beds.

Figure 11: Prior to implementation of BMPs (Fall, 2002)

Figure 12: Post-BMP implementation (Spring 2003)

Often banks are found to be eroding at transitional areas between cut banks on corners. Figure 13 and Figure 14 illustrate how little time is required for riparian vegetation to re-establish on the banks once the soil is stabilized in place using BMPs. The time lapse between the photos is roughly six months. Treatments along 4,275 linear feet of stream bank and 15 bank barbs were required at this project. Roughly, 2,100 linear feet of log revetments were used as additional retention devices at strategic locations.

Figure 13: Cut banks prior to reclamation

Figure 14: Cut banks six months after reclamation

Project #4 (Heber Boehme)

This project, conducted on landowner Heber Boehme's property, was one of the first along Thomas Fork to address bank stability. Now five years old, riparian vegetation is abundant along treated and untreated banks. Figure 15 shows the ability of vegetation to stabilize the bank when treated and protected.

The vegetation in the picture along the banks is reed canary grass, which is a non-native species. In some locations, this species out-competes the native grass seed mix applied.

Rock provides a temporary solution until a more permanent vegetative cover can be established. This bank was rip-wrapped from top to bottom to keep soil in place until vegetation could establish. Despite the fact that, in purist terms, it should not be used as a remedy for erosion, rock rip-wrap accomplishes the objective of bank stabilization and nutrient uptake and is particularly useful in areas where aesthetics are not as important as functionality.

Conversation with landowners along Thomas Fork has indicated they lose about three feet of valuable farm ground each year because of erosion. After BMPs are implemented, that number is drastically reduced.

Further illustration of the benefit of BMP implementation can be seen in Figure 16. The left side of the picture is Heber Boehme's property after treatment with BMPs and allowing re-establishment of riparian vegetation. The right side of the picture lacks BMPs and an alternative to grazing management. Prior to treatment, both sides of the fence looked like that on the right side. Clearly, implementation of BMPs and landowner cooperation results in a distinct improvement. Bank shaping and other treatments on this project totaled 1,743 linear feet with placement of 13 bank barbs.

Figure 15: Results of vegetation after five years

Figure 16: Illustration of the benefits of treated versus untreated land

Project #3 (Garth Boehme)

Garth's first bank stabilization project was completed in conjunction with several other projects that seek to keep sediment and nutrients out of the Thomas Fork. The photo in Figure 17 was taken six years after treatment, at the downstream terminus of the project from the bridge installed during previous projects. This photograph illustrates the benefit of implementing BMPs on eroding banks and the resulting effect on the channel.

As with many other locations along Thomas Fork Creek, this stretch was much wider during low flow before BMP implementation. Prior to construction of upstream bank barbs and bank shaping at this site, the channel possessed a much greater width to depth ratio. Post-BMP implementation has the streambed in a more confined channel with an aggraded gravel bed that is only submerged during higher flows.

Monitoring indicates that prior to construction the streambed was over twice the current width. The right edge of the photo was the edge of the creek prior to rehabilitation. Rip-wrap placed as temporary treatment has been secondary in benefit to riparian vegetation. This location has a strong community of willows on the opposing bank, where previously only vertical bank was present. The bank on the left-hand side was shaped, and then rip-wrapped. After several years, the rip-wrap is no longer visible and has been completely overgrown with willow communities.

The other benefit in this area is the gravel bed, which has aggraded vertically and horizontally and reduced the channel width. Treatments at this location include: bank shaping along 1,500 linear feet, 900 feet of log revetments, and 15 bank barbs constructed at strategic locations. In addition, 2,000 linear feet of fence were erected for livestock exclusion.

Figure 17: Vegetation and stream channel after six years

Project #2 (Garth Boehme)

In addition to bank stabilization and BMP implementation on Thomas Fork, other upland projects have been completed as well. A manure management facility, consisting of a manure bunker, separator and constructed wetland, has been completed to reduce nutrients entering Thomas Fork (Figure 18). The constructed wetland helps to take up much of the nutrients that previously entered Thomas Fork.

Figure 18: Manure bunker with wetland in the background

A bridge was also constructed at this location to remedy pollution caused by dumping of dairy waste products. Prior to construction, a dairy operation was located on a bluff overlooking the Thomas Fork Valley. Previously, all waste products from the dairy operation were pushed over the bluff adjacent to the stream channel, where they accumulated until they were needed to fertilize cropland. The material was then scooped up and deposited in a manure spreader, which was hauled through Thomas Fork to adjacent cropland.

To remedy this water pollution problem, a nutrient management facility was constructed. Any waste products produced by the dairy are now deposited in the separator, where the solids and liquids are directed to different locations. The solids remain in a concrete bunker until they are spread on cropland. The liquids are piped to a constructed wetland where the nutrients can be utilized by plant material. The bridge allows passage over Thomas Fork without contamination from the manure spreader.

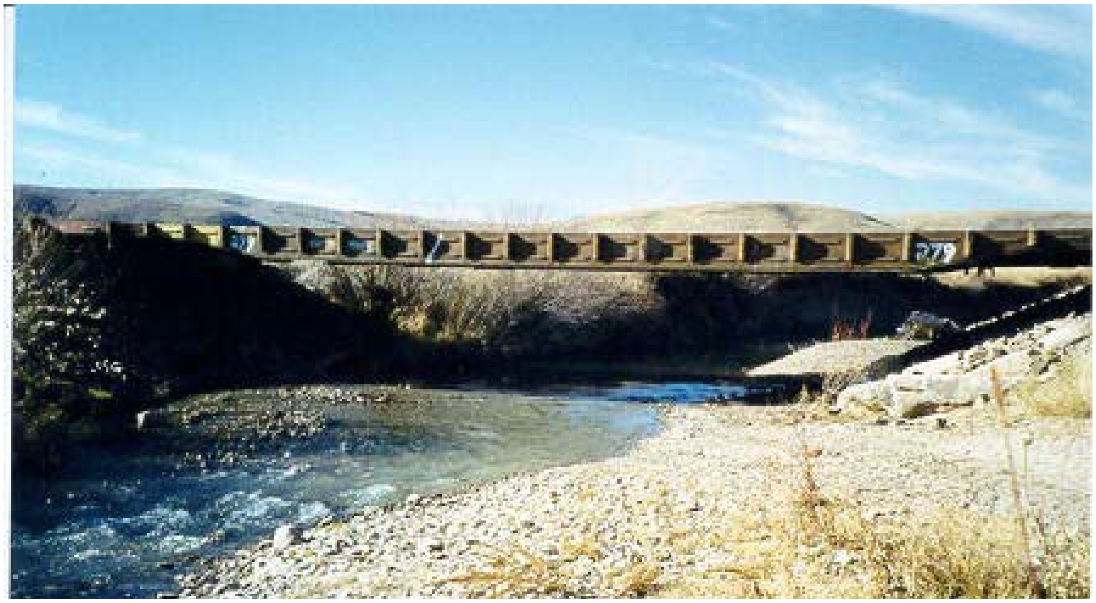

Figure 19: Bridge crossing made from an old railroad flatbed car. Since this photo was taken, vegetation has taken over the flood plain where the photographer stood.

Summary and Conclusion

Non-Point Source § 319 grants have been awarded to the Bear Lake Regional Commission to help landowners along Thomas Fork Creek implement Best Management Practices over seven years. These practices have resulted in over 11,000 linear feet of stream bank being held in place, using such treatments as bank shaping, revetments, rip-wrap, bank barbs, and vegetation.

These projects have proven successful on a number of levels. Treatments applied have retained soil in place for seven years, and photo monitoring of strategic locations has verified this. Cross sectional surveys of the stream have shown the benefit of stabilizing the banks with BMPs.

Results from monitoring indicate that for each foot of treated stream bank, 50 cubic feet of stream bank material was retained on the banks over a three-year period. This retained material per foot, when expanded to the entire treated area, equals over 500,000 cubic feet of material retained in place.

Further success has been noted in landowner perceptions to treatments. Many landowners were skeptical of BMPs implemented on neighboring lands. However, those perceptions have slowly dissolved as projects show success in stabilizing land and enhancing values. Because landowners, along with other sources, help provide the labor and materials necessary for a successful project, this cooperative spirit is crucial to the success of these projects.

The success of bank stabilization work on the Thomas Fork comes from a combination of factors, none of which can stand alone. The cooperation between the State of Idaho Department of Environmental Quality and local landowners provides a strong foundation for successful implementation. Money provided by the state allows construction to proceed, while the landowner ensures success by proper management. Both entities benefit through improved water quality and stabilized soil. The Bear Lake Regional Commission has been pleased to sponsor these projects and act on behalf of the landowners in carrying out implementation of Best Management Practices. It is the hope of the regional commission board members that this relationship will continue for years to come, until Thomas Fork Creek is once again classified as “fishable and swimmable.”